

REMARKS

The present preliminary amendment is submitted in order to correct the improper multiple dependency of claims as originally filed, to conform the application with U.S. practice and to incorporate the changes made in the parent application.

Examination on the merits is respectfully requested.

Respectfully submitted,



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Piste-Maintenance Tracklaying Vehicle

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BACKGROUND OF THE INVENTION

The present invention relates to a piste-maintenance tracklaying vehicle, [comprising an internal combustion engine which is drivingly connected, preferably via a gear, to a drive sprocket of each track, and accessory drives for additional devices that are mountable on the piste-maintenance vehicle, such as rotary snow plow, front snow plow blower, or the like, and/or for vehicle components, such as a tilting device for platform and driver's cab or for track tensioning.

Such a tracklaying vehicle is known in practice, with hydrostatic drive being normally provided for the tracks. The drive is operated by the internal combustion engine, with a gear being optionally provided between internal combustion engine and hydrostatic gear or drive sprocket for controlling the individual tracks. Furthermore, such a tracklaying vehicle has a number of additional devices, such as a rotary snow plow, a front snow plow blower, a winch drive, or the like. Furthermore, adjusting mechanisms for the corresponding device carriers or for a snow clearing blade are provided for the additional devices or also for further vehicle means, tilting devices are provided, for instance, for the driver's cab or a platform, as well as a track tensioner, or the like.]

Such a vehicle is known from WO94/09548. In the prior-art vehicle, an electric motor for a drive wheel of a track is driven by an internal combustion engine via a generator. In the overrun mode, the electric motor can be switched as a current generator for accessory drives of the vehicle. Such accessory drives are intended for additional devices that are mountable on the piste-maintenance vehicle, such as a rotary snow plow, a front snow plow blower, or the like, and/or for vehicle components, such as a tilting device for platform and driver's cab or for track tensioning.

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The prior-art tracklaying vehicle has the disadvantage that ~~{the hydrostatic drive for the tracks is relatively heavy and the total drive system for the tracklaying vehicle is of a relatively poor efficiency.}~~ for instance electric motors for a snow plow shaft are directly
35 controlled by a high-performance control unit, without any information being furnished on
a dependence of such a control unit on the vehicle speed, or the like.

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SUMMARY OF THE INVENTION

5 It is therefore the object of the present invention to improve a tracklaying vehicle of the above-mentioned type in such a manner that ~~[the tracklaying vehicle is more lightweight with the positive characteristics of the prior art drive of the tracklaying vehicle being maintained, and that the efficiency of the tracklaying vehicle drive is increased at the same time, as well as the uniformity of piste maintenance.]~~ a uniform piste maintenance of an
 10 unvarying high quality is ensured independently of the vehicle speed or an uphill or downhill driving of the vehicle.

In a tracklaying vehicle ~~[comprising the features of the preamble of claim 1,]~~ this object is achieved in that the ~~[internal combustion engine is connected via a generator and at least one electric motor and possibly via a gear to each drive sprocket and that in the overrun mode the electric motor is switchable as a current generator for accessory drives designed as electrohydraulic or electric drives, with at least the electric drive for a shaft of the snow plow being synchronized with the electric motor of the drive sprocket.~~

15 In comparison with a known hydrostatic drive, ~~the inventive use of generator and of at least one electric motor yields an equally good protection against and resistance to environmental factors and overloading. At the same time, the electric motor permits a precise control of the power transmission; due to the increased efficiency of the electric drive system the latter yields an identical or even increased tractive force on the drive sprocket and a vehicle~~
 20 ~~performance comparable to or even better than that of hydrostatic drive.~~

In the absence of all of the hydraulic components of the hydrostatic drive in the drive train, ~~the inventive use of generator and electric motor considerably reduces the weight for the tracklaying vehicle. Furthermore, difficulties which might arise from sealing and from the~~
 30 ~~hydraulic medium supply of the hydrostatic drive are not observed.]~~ electric drive for a shaft of the snow plow is synchronized with the electric motor for the drive sprocket. It is

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thus possible to adapt snow plow shaft speed and travel speed to one another, resulting in a defined number of tooth engagements of the snow plow shaft per distance covered.

Furthermore, in comparison with hydrostatic drives that are known in practice, one
generally obtains an equally good protection against and resistance to environmental factors
and overloading. The electric motor permits a precise control of the power transmission.
Due to the increased efficiency of the electric drive system the latter yields an identical or
even increased tractive force on the drive sprocket and a vehicle performance comparable
to or even better than that of a hydrostatic drive.

Since all of the hydraulic components of a hydrostatic drive in the drive train are no
longer needed, the weight of the piste-maintenance vehicle is considerably reduced, and all
difficulties that might arise from sealing and from the hydraulic medium supply of a
hydrostatic drive are no longer observed.

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Generator and electric motor and the corresponding connections between said members and
5 to the internal combustion engine can be installed easily and without any major changes on
the main frame of the tracklaying vehicle. Furthermore, an electric motor is exactly
controllable in its performance and can be used as a brake during downhill driving or in the
overrun mode, with energy being possibly fed back at the same time due to the generator
effect of the electric motor.

10 In addition to ~~an improved~~ a good efficiency of the drive system, such an energy feedback
effects a further reduction of the energy consumption, as the energy gained can for instance
be used directly for operating the accessory drives for the additional devices.

15 The accessory drives for the additional devices which are mountable on the vehicle and/or
for further vehicle components can be designed as electrohydraulic or electric drives.
Electric drives may for instance be preferred for rotatory movements, for instance for a
shaft of the rotary snow plow, for a front snow plow blower with screw and blower wheel,
for a winch drive, or the like. Electrohydraulic drives can be used for the adjusting
20 mechanisms at the front and rear on the tracklaying vehicle, for a parking brake, for tilting
devices, for the track tensioner, or the like. The adjusting mechanisms serve, for instance,
to adjust the corresponding device carrier at the front and rear and for adjusting additional
devices, such as front snow plow blower or snow clearing blade. A tilting device on the
tracklaying vehicle serves to tilt the driver's cab or to tilt a loading platform of the
25 tracklaying vehicle.

~~[To ensure a defined number to tooth engagements of the snow plow shaft per distance
covered, and thus uniform piste maintenance work, it further turns out to be of advantage
when the electric drive for the snow plow shaft is synchronized with the electric motor for
30 the drive sprocket. The shaft speed and traveling speed can thus be adapted to each other.]~~

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vehicle is prevented from rolling by means of power-supplied electric motors, the accelerator is operated and the piste-maintenance vehicle is moved in the end. In a development of the invention, the parking brake is operated automatically, a release of the parking brake being effected during start upon operation of the accelerator.

A stopping operation during uphill or downhill driving is effected by means of a safety logic in that in successive order the accelerator position is moved to the zero position, whereby the piste-maintenance vehicle is slowed down in a controlled manner and stopped, the vehicle is prevented from rolling by a further power supply to the electric motors, the parking brake is automatically operated after a defined stopping time, and the power supply to the electric motors is terminated and the internal combustion engine is further operated in the idling speed mode. The traveling direction switch can then be moved to the neutral position.

The above-described control by means of a setpoint or by means of the safety logic can be performed through a separate electronic control means or an electronic means contained in the vehicle control unit or the electronic high-performance means.

Advantageous embodiments of the present invention will now be explained and described in more detail with reference to the figures attached to the drawing, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram regarding drive and supply of a tracklaying vehicle;

Fig. 2 shows various variants of arranging electric motors and gears;

Fig. 3 is a side view of a first embodiment of a tracklaying vehicle;[and]

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Fig. 4 is a side view of a further embodiment of a tracklaying vehicle of the invention[.] ; and

Fig. 5 is a side view of a further embodiment of a tracklaying vehicle of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram for drive and supply with additional devices and further vehicle components.

An internal combustion engine 2 is drivingly connected to a generator 10 for producing electric energy. Furthermore, the internal combustion engine 2 drives a dynamo 27 by which a corresponding vehicle battery 26 can be charged.

An electronic high-performance means 21 which can be fed with current from the generator 10 is centrally arranged in the tracklaying vehicle 1, of which Fig. 1 only shows the principle. The electronic high-performance means 21 controls downstream electric motors 11, 12 for driving the tracklaying vehicle 1. These motors are drivingly connected via corresponding gears 3,13,14 to the drive sprockets 4 of the tracks of the tracklaying vehicle 1.

Energy and information flows between the individual components are represented in Fig. 1 by the directions of arrows. For instance, energy flows from the electronic high-performance means 21 via the electric motors 11, 12 and gears 3,13,14 to the drive sprockets 4. During downhill driving or in the overrun mode the drive sprockets 4 inversely drive the electric motors 11, 12 via the gears 3,13,14 so that these motors can be used as generators and feed energy back via the electronic high-performance means 21.

Furthermore, there is provided a vehicle control unit 28 which on the basis of corresponding predetermined setpoints of accelerator 29 and steering wheel 30 controls as a setpoint transmitter both the internal combustion engine 2 and the electronic high-performance means 21 and transmits the setpoints as control

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components, there is maximum freedom of design by virtue of the electrical connection of said components; as a consequence, it is possible to arrange the drive train on the tracklaying vehicle in different ways. In the illustrated embodiment, the electric motor 11 is directly assigned to the drive sprocket 4 which drives a track 5.

The tracklaying vehicle 1 comprises as further vehicle components 15, 16 a loading platform 31 and a driver's cab 32. These parts are tiltable by electric or electrohydraulic drives [(not shown)] 52.

A control block 22 and 23, respectively, is arranged at the front and at the rear of the tracklaying vehicle 1. By analogy with Fig. 1, the block is designed with an electrohydraulic drive 18 as the accessory drive 6. These control blocks 22, 23 serve, for instance, to operate an adjusting means for push frame, [front snow plow blower] or device carrier, which are not illustrated for the sake of simplicity. Reference numerals 9 and 18a outline only the principle of a front snow plow blower to be arranged on the corresponding front device carrier 18a of the tracklaying vehicle 1.

The vehicle control unit 28 and a diagnosis means 25 are arranged inside the driver's cab. The diagnosis means serves maintenance and inspection purposes. The diagnosis means can also be arranged at a different location of the tracklaying vehicle 1.

Fig. 4 is a side view illustrating a further embodiment of a tracklaying vehicle 1. Like reference numerals designate like parts and are only mentioned in part.

At the rear of the tracklaying vehicle 1, a rotary snow plow with a downstream smoothing blade is arranged as an additional device 8. The snow plow comprises a shaft which is driven by an electric drive 19. The additional device 8 is adjustably and

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pivotably supported at the rear of the tracklaying vehicle 1 via a corresponding kinematic adjusting means with electrohydraulic drive 18.

The kinematic adjusting means for the additional device 8 can be operated via the rear control block 23, the electrohydraulic drive 18 being contained in the rear control block 23 in such a case.

A winch which comprises a reel with an electric drive 19 is arranged as a further additional device 7 on the loading platform 31.

Further additional devices or vehicle components, such as track tensioner 56, parking brake 58, [front device carrier, or the like, are not shown in Figs. 3 and 4 for reasons of simplification] snow plow blower or the like shown in Figs. 3, 4 and 5.

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